Medicinal Chemistry practical (#131703425)
First Semester 2023 /2024

COURSE INFORMATION	
Course Name: Medicinal chemistry practical **Learning method:** Hybrid learning **Semester:** Second **Department:** Pharmaceutical Chemistry **Faculty:** Pharmaceutical Sciences	**Course Code:** 131703425 **Section:** As per semester **Core Curriculum**: 2013 Study Plan **JNQF Level:** 7
Day(s) and Time(s): According to HU courses timetable/semester **Classroom:** As per semester **Date prepared:** January 2020 **Date updated:** February 2024	**Credit Hours:** 1 **Prerequisites**: 131703424 (Medicinal chemistry 2) or parallel

COURSE DESCRIPTION

Medicinal Chemistry is the study of how new drugs are developed and tested. In this course, you learn the basics of drug's synthesis, drug design and development. Medicinal chemistry requires an understanding of how chemistry, biology, mathematics and computing interact with each other to allow the scientist to effectively create new pharmaceuticals that will prevent or stop one or more disease conditions. This practical course in medicinal chemistry concerned with multistep synthesis of selected medicinal compounds.

The successful medicinal chemist is an expert organic chemist who has, or can acquire, sufficient knowledge in other disciplines to apply that knowledge to drug synthesis and design. We shall have opportunities to illustrate the dependence of medicinal chemistry on knowledge from other disciplines as we progress through this course. So our course will build on the experience gained from organic chemistry lab through the synthesis and characterization of complex molecules, the acquisition and interpretation of physical data and the investigation of chemical systems through computational techniques gained in analytical and instrumental labs. It consists of a series of laboratory-based experiments aimed at developing skills in the synthesis, safe handling and analysis of chemical substances of a range of different classes of compounds; an understanding of modern characterization techniques (e.g. chromatography, atomic and molecular spectroscopy); and the operation of instrumentation for the acquisition of kinetic, structural and thermodynamic data.

In addition to increased proficiency in standard techniques, this course provides an introduction into research-based chemistry through integrated and themed experiments. It will provide skill development in a range of techniques utilized in the modern chemistry laboratory. The subject provides experience across multiple traditional chemical disciplines whilst highlighting the importance of these disciplines in diverse 'real world' applications such as materials science and medicinal chemistry.

This Lab class is divided into two parts: the first part will focus on three synthesis cycles; multi – step Synthesis of Sulfanilamide, Benzocaine and Phenytoin, using techniques of organic compounds that an organic chemist uses daily; including crystallization, distillation, and extraction and will be run in groups. The second part focuses on Molecular modeling using computer software's for drug design.

DELIVERY METHODS

The theoretical part of the lab is delivered through Microsoft Teams, and the practical part is run in the lab

FACULTY INFORMATION

Name	**Dr Asma Fakhoury**	**Dr Rand Shahin**
Academic Title:	**Assistant Professor**	**Associate professor**
Office Location:	**Third Floor (A410)**	**Third floor**
Telephone Number:	**Extension: 3434**	**Extension: 3442**
Email Address:	**a.fakhoury@hu.edu.jo**	**r.shahin@hu.edu.jo**
Office Hours:	**As announced per semester** ***Please send an e-mail to meet at any other time.***	

REFERENCES AND LEARNING RESOURCES

Supplementary Textbook(s):.

1. Wilson and Gisvold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, 11th Edition, 2004, Lea & Febiger.
2. Foye's Principles of Medicinal Chemistry, David A Williams, William O Foye and Thomas L Lemke, 6th Edition, 2008, Lippincott Williams & Wilkins.
3. Organic Chemistry: A Short Course. By Harold Hart, Leslie E. Craine, David J. Hart. Publisher: Houghton Mifflin College; 10th edition (January 1999) ISBN. 0395902258

Useful Web Resources:

As per each lab.

COURSE OBJECTIVES

The objectives of this course are:

1. Familiarize students with techniques commonly used in the medicinal chemistry laboratory.
2. Understand the multistep synthesis of a drug and how get it in good yield and in pure form.
3. Demonstrate the effect of the different synthetic methodology.
4. Clarify theoretical concepts of chemical synthesis of drug molecules.
5. Gain experience in handling and proper usage of laboratory glassware, equipment, and chemicals.
6. Learn how to keep an accurate and readable record of all experimental work and how to write a scientific report.
7. Master a variety of synthetic techniques including purification methods and the design a synthetic scheme for a proposed drug molecule.
8. Familiarise students with the use of drugs design software.
9. Improve the students' oral and written communication skills, through practical report and written assignments and oral tasks.

COURSE INTENDED LEARNING OUTCOMES (CILOs)

A. Foundational Knowledge

A1. Understand the general laboratory safety and basic techniques.
A2. Understand the principles of drug synthesis of different drugs.

B. Essentials for Practice and Care

B1. Identify mistakes done during the assay to avoid them.
B2. Discuss a chemical/physical assay for the identification of the quality/purity of drug.
B3. Interpret scientific data in the form of a scientific report.

C. Approach to Practice and Care

C1. Carry out an experiment, including mixing reactants, solvents and reagents (or in silico in molecular modelling experiments) within experimental context.
C2. Isolate and purify reaction products through (not limited to) chromatography, crystallization, distillation.
C3. Characterize the final products through standard chemical/physical procedures such as melting point, NMR, etc.

D. Personal and Professional Development

D1. Practice teamwork.
D2. Develop problem solving and critical thinking skill

ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities

are encouraged to contact their instructor to ensure that their individual needs are met. The University through its Special Need section will exert all efforts to accommodate for individual's needs.

Special Needs Section:

Tel: **00962-5-3903333 Extension: 4209**
Location: **Students Affairs Deanship/ Department of Student Welfare Services**
Email: **amalomoush@hu.edu.jo**
amalomoush@staff.hu.edu.jo

COURSE REGULATIONS

Participation

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student should not miss more than 15% of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. **Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.**

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

On average, students need to spend 6 hrs of study and preparation weekly. At the beginning of the lectures, students should be on time and should not leave before the end of the lecture without an accepted excuse. **If the student missed a class, it is his/her responsibility to find out about any announcements or assignments they have missed.** For any clarification, students should communicate with their instructor at her posted office hours or by appointment. Students should listen well to the lecture, if anyone has a question, he/she should ask the instructor. Students can find the course material at the course Microsoft team/Model after the lecture.

Sharing of course materials is forbidden. No course material including, but not limited to, course outline, lecture hand-outs, videos, exams, and assignments may be shared online or with anyone outside the class. Any suspected unauthorized sharing of materials, will be reported to the university's Legal Affairs Office. If a student violates this restriction, it could lead to student misconduct procedures.

Plagiarism

Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own integrity as well as that of The Hashemite University.

Plagiarism includes the following examples, and it applies to all student assignments or submitted work:

- **Use of the work, ideas, images or words of someone else without his/her permission or reference to them.**
- **Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.**
- **Misrepresentation of the sources that were used.**

The instructor has the right to fail the coursework or deduct marks where plagiarism is detected.

Missed Assessments

In all cases of assessment, students who fails to attend an exam on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive a failure grade for this part of the assessment.

In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with university regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

Cheating

Cheating, academic disconduct, fabrication and plagiarism will not be tolerated, and the university policy will be applied. Cheating policy: The participation, the commitment of cheating will lead to applying all following penalties together:

- Failing the subject, he/she cheated at.
- Failing the other subjects taken in the same course.
- Not allowed to register for the next semester.
- The summer semester is not considered as a semester.

Student Complaints Policy

Students at The Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

COURSE ASSESSMENT

Course Calendar and Assessment

Students will be graded through the following means of assessment:

Course Assessment Plan						
Assessment	**Grade Weighting**	**Deadline Assessment**	**CILOs**			
			A	**B**	**C**	**D**
Midterm Exam	30%	6th week	A	B	C	D
Reports, quizzes and evaluation	30%	weekly	A	B	C	D
Final Exam	40%	12th week	A	B	C	D

Description of Exams

Test questions will predominately come from material presented in the lectures and the lectures themselves. Semester exams may be conducted during the regularly scheduled lecture period. Exam may consist of a combination of multiple choice, short answer, match, true and false, and/or descriptive questions.

No make-up exams will be given. Only documented absences will be considered as per HU guidelines. Make-up exams may be different from regular exams in content and format.

Grades are not negotiable and are awarded according to the following criteria:

Letter Grade	Description	Grade Points
A+	Excellent	4.00
A		3.75
A-		3.50
B+	Very Good	3.25
B		3.00
B-		2.75
C+	Good	2.50
C		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00
I	Incomplete	-

WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION

"Lecture hours and weeks are approximate and may change as needed"

Note: Starting from week 2, One lab period covers 3 hours. 1 hour experiment explanation and discussion through Microsoft Teams and 2 hours practical work in the lab.

Course Content					
Week Number	**No. of Hours**	**CILOs**	**Subject**	**Delivery Methods**	**Assessment Methods**
1	**1**	A1, A3, C1, D1,	General instruction and safety rules and laboratory apparatus	Lecture+ discussion Video presentations & Animation	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
2	**3**	A1, A2, B1-3 C1-3 D1, D2	Benzocaine synthesis	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
3	**3**	A1, A2, B1-3 C1-3 D1, D2	Multi – step Synthesis of Phenytoin: Benzoin condensation	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
4	**3**	A1, A2, B1-3 C1-3 D1, D2	Multi – step Synthesis of Phenytoin: Oxidation of Benzoin to Benzil	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
5	**3**	A1, A2, B1-3 C1-3 D1, D2	Multi – step Synthesis of Phenytoin: condensation of Benzil with urea to form dilantin (Phenytoin).	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
6	**3**	A1, A2, B1-3 C1-3 D1, D2	Multi-step Synthesis of Sulfanilamide: Synthesis of Acetanilide	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
7	**3**	A1, A2, B1-3 C1-3 D1, D2	Multi-step Synthesis of Sulfanilamide: Synthesis of p-Acetamidobenzenesulfonyl chloride	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
8	**3**	A1, A2, B1-3 C1-3 D1, D2	Multi-step Synthesis of Sulfanilamide: Synthesis of p-acetamidobenzenesulfonamid	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams

9	**3**	A1, A2, B1-3 C1-3 D1, D2	Multi-step Synthesis of Sulfanilamide: Synthesis of p-Aminobenzenesulfonamide (Sulfanilamide	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
10	**3**	C1, D2, D2	Molecular modeling: In silico prediction of Ionization Constants of Drugs	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
11	**3**	C1, D2, D2	Molecular modeling: SAR analysis using accelrys software	Brief discussion + Video for laboratory work + Brainstorming	Class participation Laboratory Report Quizzes, Lab work evaluation, Assignment, Exams
12	**1**	A1, A2, B1-3 C1-3 D1, D2	**Final exam**	-	Exams